MPA material matters

January 2007

Newsletter of the Materials Physics and Applications Division

Terahertz-controlling device offers possibilities for new imaging, communication devices

Research appears in Nature

MPA-CINT researchers and colleagues have built a device that can manipulate terahertz (THz) radiation, raising hopes for applications in new imaging and communications devices. The THz range of the frequency spectrum lies between infrared and microwave wavelengths. Devices that generate and detect THz radiation are already in development, but techniques to control the waves are lagging behind.

In "Active Terahertz Metamaterial Devices" (*Nature* **444**, 2006), Hou-Tong Chen, MPA-CINT, and Willie Padilla, formerly of MPA-CINT, now at Boston College, show that metamaterials (objects with properties based on their structure instead of the materials they are composed of) can be designed to efficiently control THz waves in real time. They built a device consisting of a semiconductor substrate with an array of gold structures on top. By controlling the voltage applied between the substrate and the metamaterial, the team can modulate the transmitted intensity up to 50 percent. The demonstration already exceeds the performance of existing electrical THz modulators, and it's hoped that the efficiency will be improved further by optimizing the device.

In addition to Chen and Padilla, authors include J. M. O. Zide and A. C. Gossard, both UC Santa Barbara, and Antoinette J. Taylor and Richard D. Averitt, both MPA-CINT. LDRD and the Center for Integrated Nanotechnologies, a DOE/Office of Science Nanoscale Science Research Center, supported the research.

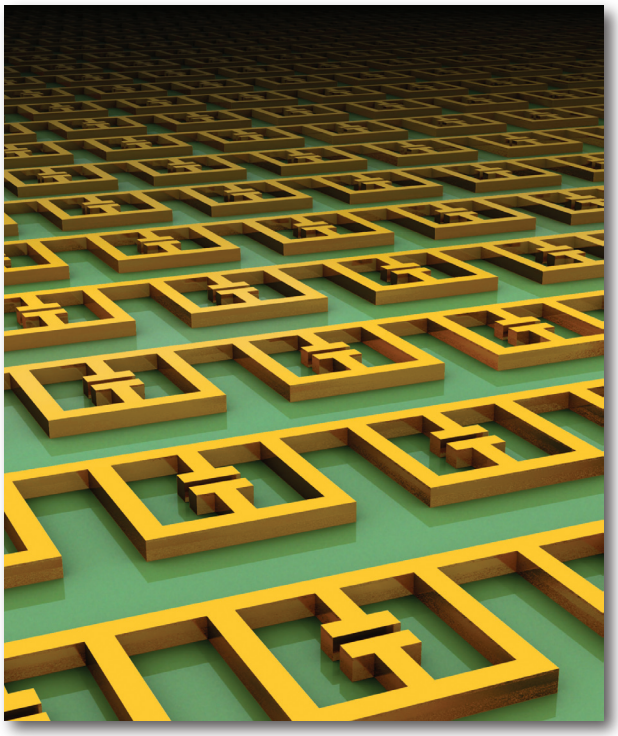

Illustration by Vicente Garcia, IRM-CAS

The emergence of terahertz electronics based on metamaterials.

INSIDE this issue

From John's Desk 2

New materials seminar series 3

Heads Up, MPA! 4

MPA newsmaker

NHMFL's Albert Migliori elected Fellow of Acoustical Society of America

Albert Migliori, MPA-NHMFL, has been elected a Fellow of the Acoustical Society of America. The award is "for contributions to the use of acoustics in condensed matter physics."

Migliori, who received his PhD in physics from the University of Illinois before coming to Los Alamos as a Director's postdoctoral researcher in 1973, became a staff member in 1976. He is an American Physical Society Fellow, a Los Alamos Laboratory Fellow, the deputy director of the Los Alamos branch of the G. T. Seaborg Institute for Transactinium Science, a co-discoverer of acoustic heat engines, and a leading expert in the use of resonant ultrasound spectroscopy.

The 7,000 member Acoustical Society of America is the premier international scientific society in acoustics dedicated to increasing knowledge

"Migliori" continued on page 4

From John's desk

Materials Physics and Applications: Challenges, opportunities of a new year

I hope that you all had a restful and relaxing holiday break—without too much time spent shoveling snow—and have returned re-energized to embrace the challenges and opportunities of a new year.

One thing that didn't change over the break was the Laboratory's budget. For FY07 we remain under a continuing resolution that seems likely to be extended for the entire year. In just a couple weeks, the President will release his FY08 budget, creating the relatively rare situation of having two yet-to-be-enacted budgets at once, which adds additional uncertainty to the system. More locally, we completed our ADEPS first quarter budget review last week. MPA's overall position is strong, but challenges exist in other divisions within EPS (and across the Laboratory).

Thus, I urge you to remain fiscally conservative and frugal. Another impact of our tight budget is a greater focus on budget forecasting. Please work with your group leaders as we try to develop and refine spending plans to estimate our total costs over the course of the year. While this can be difficult for basic research-focused projects, it is an important element of insuring our overall stability and sustainability.

On the safety front, I'd like to share with you one of my new year's resolutions. Through the LANS transition, Management Walk-Arounds (MWAs) have been renamed MOVs (Management Observation and Verifications). Whatever their name, these are important opportunities for your management to interact with you "where you work."

Our expectation is that each manager will do at least one MOV per month (and hopefully you see your group leader far more frequently than this). I've committed to do one MOV per week with one of your group leaders. If you would like us to visit your lab or walk down your space, please let your group leader know, and we'll try to accommodate your request.

On security, issues associated with classified computing and vault operations continue to be an area of focus at the Laboratory. While the direct impact of this effort is rather limited in MPA, recent leadership changes at NNSA do make clear our focus on personal accountability, even at the highest levels of management.

Finally, I'd like to remind you of several upcoming meetings. We will have our first "State of MPA" All-Hands Meeting on Wednesday, January 24, at 11 a.m. in the Physics Auditorium. We will highlight some of our successes over the past six months and update you on our strategic priorities and program opportunities in the next six or so months.

As one step in enabling this strategy, we'll also have several LDRD town hall meetings (Jan. 19 at 11 a.m. in the MSL Auditorium and Jan. 25 at 10 a.m. in the STC Conference Room) focused on LDRD-DR strategy and process within MPA. LDRD is a large fraction of our overall budget, and collectively understanding our areas of focus is an important element of leveraging our success.

I'll have more to say about our current portfolio and program development efforts across nuclear weapons, threat reduction, and science program office customers during the All-Hands meeting.

—Materials Physics and Applications Division Leader John Sarrao

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Celebrating service

New MST seminar series features renowned materials scientists

A new materials science seminar series featuring esteemed nationally and internationally known scientists begins this month.

MST-8 sponsors the series designed to offer Laboratory audiences the opportunity to hear broad, visionary talks at a high scientific and engineering level.

Roger Doherty

Dr. Roger Doherty, the A.W. Grosvenor Professor of Materials Engineering at Drexel University, will present the first talk on Jan. 25 in the Materials Science Laboratory Auditorium. He will discuss his recent studies into a predictive model of abnormal grain coarsening (AGC). These involve a new curvature model for inhibition of normal grain coarsening by second phase particles, the possible role of second phase particle stability and the unexpected role of a high density of low angle grain boundaries in stimulating AGC. Doherty has been fascinated by this problem since he was a doctoral student researching the role of second phase particles on recrystallization process in deformed Al-Cu alloys at Oxford University in the early 1960s.

A former materials science lecturer in the School of Engineering and Applied Sciences at Sussex University, United Kingdom, Doherty has been a technical assistance expert for the materials department of the Brazilian Aerospace Center in Sao Paulo, Brazil, and a guest professor of applied metallurgy at Delft University of Technology in Holland. He has been a consultant for Alcoa Technical Center in Pittsburgh, Howmet Turbine Components Corporation, SPS Technologies and Los Alamos National Laboratory. His research interests cover many aspects of industrial processing of alloys, solidification, precipitation strengthening, and particularly deformation and recrystallization processing. He has written more than 200 refereed technical publications, holds seven U.S. patents, and is the co-author of two textbooks.

The seminars, scheduled for the last Thursday of the month starting at 3 p.m. in the MSL Auditorium, will consist of 45 minute presentations followed by a 15 minute question and answer session.

Laboratory's meal policy revised

The Laboratory's meal policy is being revised to bring it in line with the Department of Energy's latest policy on meals, refreshments, and beverages. This new policy is designed to ensure that prudent cost management is practiced across the DOE complex.

Effective February 1, meals are allowable only at non-routine events with a valid business purpose, and where the participants cannot leave "without irreparably damaging the purpose of the event." (Department of Energy Acquisition Regulation – Acquisition Letter No. AL-2005-12.)

Key requirements of the policy (ISD 815-1 Allowable Cost Manual, Chapter 3) are as follows: meals, refreshments, and beverages must be approved by the Associate Directors; meal costs are limited to the Federal Travel Regulation rate that applies to the event location; the requirements for outside participants and specific event durations/hours have been eliminated; interview meals will only be paid for those parties that are on official travel, a situation cited directly in the Acquisition Letter; reception costs are no longer allowable, as the Acquisition Letter cites receptions as primarily social events; the documentation must include an agenda and a list of invitees.

MPA well represented at actinides symposium of 2006 MRS Fall Meeting

The third actinide symposium for the Materials Research Society's (MRS) fall meeting took place in Boston.

This symposium was initiated in 2003 with participation form several national labs and universities interested in actinide research.

Los Alamos National Laboratory and Lawrence Livermore National Laboratory have provided the funding for the symposium from inception and were the leading institutions for organizing the symposium.

This year the symposium ran for four days with Los Alamos scientists making several presentations. Among the Los Alamos presenters, MPA Division Leader John Sarrao and MPA-10's Joe Thompson gave a tutorial presentation. MST-6's Jim Smith and Jason Lashley, MPA-10's Nick Curro, and C-IIAC's Sean Reilly gave invited presentations.

The symposium covered the physics, chemistry and materials science of actinides from basic research to applications and technology.

Details of the meeting including the technical program may be found at the MRS website (www.mrs.org) by following the links to the 2006 Fall meeting and Symposium OO: Actinides.

STC at ISS 2006

MPA-STC Center Leader Dean Peterson recently presented the special plenary lecture at the 19th International Symposium on Superconductivity held in Nagoya, Japan. Peterson gave an overview status on coated conductor wire development within the United States. In addition, he co-chaired a session highlighting the 20th anniversary of the discovery of high temperature superconductors. MPA-STC's Leonardo Civale presented an invited talk on vortex pinning in coated conductors at the symposium, which included more than 700 attendees from 25 nations.

Heads UP, MPA!

Navigating the new vehicle access portals

Think safety first when approaching the new vehicle access portals (VAPs) at East Jemez and West Jemez drives. Approach the VAPs with caution, think ahead, and be courteous to fellow drivers. Allow enough time for lane changes, allow others to get into the lane they need to, and merge correctly. Follow the verbal or hand signal directions of the Protective Force officers.

The new access portals are part of the security perimeter project intended to enhance the perimeter of Los Alamos National Laboratory in order to protect against the possibility of terrorist attacks.

A video explaining the access requirements for the new East Jemez and West Jemez vehicle access portals is available at http://int.lanl.gov/security/perimeter/video.shtml. A security perimeter reference guide for Laboratory employees and visitors can be found at http://int.lanl.gov/security/perimeter/docs/brochure.pdf.

Steady on your feet

Winter means dealing with cold, ice, and snow—all which can add up to an increased chance of slips, trips, and falls. Slips in the winter are primarily caused by a slippery surface, wearing the wrong footwear, and distraction.

The Laboratory's "Slips, Trips, and Falls—The Winter 3," Safety Short, available at http://int.lanl.gov/safety/safetyshort/slips/flier.pdf, outlines changes you can make to protect yourself.

Proper disposal of sensitive information

The recycle bin is not the appropriate place for documents that contain official use only (OUO) information or personally identifiable information (PII).

These documents must either be placed in burn boxes or destroyed by using a strip-cut shredder that produces strips no more than 1/4 inch wide.

More information on destroying unclassified controlled information can be found at http://int.lanl.gov/security/protectinfo/guidance.php?view=action&cls=3&act=destroying.

For more information on burn boxes, see http://int.lanl.gov/security/documents/security-smart/burnit0406.pdf.

For more information on OUO, see http://int.lanl.gov/security/documents/security-smart/ouo_1206.pdf.

Detecting unusual behavior and your responsibilities

Unusual behavior—sometimes caused by stress, depression, substance abuse, psychological problems, and disgruntlement—can have serious safety and security consequences if it is not addressed.

Laboratory workers have a responsibility to make sure we and our coworkers perform our jobs reliably. A new Security Smart publication, available at http://int.lanl.gov/security/documents/security-smart/behavior1_07.pdf, covers behavior that could compromise a safe and secure work environment, reporting guidelines, and resources for seeking help.

Employee can comment on revised policies through Feb. 5

Laboratory employees can comment through Feb. 5 on revised policies dealing with substance abuse, discipline, and the Laboratory's complaint resolution program. All three draft policies are available on the Policy Center webpage.

Lab employees can send comments to policy@lanl.gov by electronic mail. For more information, see the Jan. 8 Daily NewsBulletin.

Heads UP, MPA! reports on environment, safety, and health, security, and facility-related news and information.

Self-radiation damage on the superconducting state in $PuCoGa_5$

Los Alamos researchers have used X-ray absorption fine-structure (XAFS) spectroscopy to examine the effects of self-radiation damage on the superconducting state in $PuCoGa_5$. The measurements indicate that the degree of f-orbital localization increases with radiation-induced lattice damage and that the local crystal structure is disordered much more strongly than anticipated based on standard damage models.

This work involved a collaboration between MPA-10 researchers Eric Bauer and Nelson Moreno, MPA-DO's John Sarrao, MST-8's Luis Morales, MST-16's Jeremy Mitchell, and staff at Lawrence Berkeley National Laboratory and Lawrence Livermore National Laboratory. The work has been submitted to *Physical Review Letters*. LDRD and Office of Basic Energy Sciences support the research.

"Migliori"

Continued from page 1

of acoustics and its practical applications. Founded in 1929, the Society includes national and international members from a variety of fields related to sound including physics, engineering, robotics and computer sciences, oceanography, biology, physiology, psychology, noise and noise control, architecture, speech, and music.

Got news?

MPA Material Matters features technical highlights developed each week for the Director's Office.

If you have unclassified news you'd like to see featured, please send it to your group leader to be forwarded to *MPA Material Matters* Editor Karen Kippen.